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STUDY OF SOIL (SEDIMENT) QUALITY OF SAWANGA (VITHOBA) LAKE: A FUNCTION OF VITAL LIVING SYSTEMS WITHIN ECOSYSTEM

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ABSTRACT

Soil (sediment) health is the ability of soil to perform the vital functions for living systems within ecosystem to maintain plant and animal productivity, improve quality of water and support plant and animal health. The purpose of this study was to assess soil (sediment) quality of Sawanga (Vithoba) Lake. Sawanga Lake is located in district Amravati Maharashtra India. This study began in Feb 2011 and was carried out for 12 months by taking monthly soil (sediment) samples from three different stations of the lake. Soil quality parameters like pH, Nitrogen, Phosphorus, Organic carbon, Potassium analysis were assessed. Most of the parameters were in normal range. This study indicates that soil (sediment) quality of Sawanga Lake is good to sustain the diverse flora and fauna.

KEYWORDS: Organic Carbon, Atmospheric Pollution, "Malkhed Talav"

INTRODUCTION

Soil (sediment) is significantly vital component of the earth's biosphere. The soil plays great role in the production of food and fiber, in the maintenance of the quality of local, regional and global environment (Glanz 1995). Soil quality affects agriculture and natural plant growth and communities. Due to soil erosion, atmospheric pollution, sanitization can lead to degradation of soil (Oldeman, 1994). Soil degradation and loss of productivity of soil may be the result of human caused environmental problems like change in global climate, thinning of the protective ozone layer which may lead to a serious decline in biodiversity. Soil quality has been defined by the soil science society of America as " the capacity of a specific kind of soil to function within the boundaries of natural or managed ecosystem, to sustain plant and animal productivity, maintain and enhance water and air quality, and support human health habitation" (Karlen et al., 1997). Soil is a living, dynamic system, functions of which are arbitrated by a diversity of living organisms that require management and conservation (Doran 1997). The health of the soil, its pliability and ultimately biodiversity are limited in extreme environment and affected by anthropogenic disturbances (Freckman and Virginia 1997). Soil health can be understood as a capacity of soil to function as a vital living system to sustain biological productivity, promote water quality and maintain plant and animal health. Pest management in agriculture and water ecosystem and addition of pollutants from the various sources has a substantial effect on the degradation and reduction of soil health (Saunders, 1992 and Oldeman, 1994).

Distribution of plants and animal's and their density of population are affected by seasonal variation in the ecological parameters (Odum1971). Soil chemistry can be used as an indicator of functioning of terrestrial ecosystems. The major biogeochemical processes affect the chemical composition of the liquid and solid phase of the soil. The soil chemical data is affected by soil physical and microbiological factors. The objective of the present study is to assess the status of Sawanga Vithoba Lake ecosystem by evaluating the soil quality of the lake.

MATERIALS AND METHODS

The Sawanga Lake covers approximately 10 km^2 and is located near Sawanga Village. It is approximately 17 km east to district Amravati of state Maharashtra India (figure 1). It is also referred as "Malkhed Talav". The geographical and morphological features of the lake is described in table no 1.

Present study was carried out for all the months of a year. Month wise sampling was done. Sampling was done once a week. Lake area was divided as East (station 1), West (station 2), and North (station 3), for the convenience. The sampling was performed as described in a Soil analysis kit. The collected soil samples were dried in air and then crushed in a wooden mortar with a pestle and sieved through a 2mm sieve to separate the coarse fragments (> 2mm). The fine earth samples were stored in separate containers for analysis. The physical and chemical parameters like pH, Phosphorus, Nitrogen, Organic carbon, and Potassium were assessed. All the analysis were done by standard analysis methods using *Prerana soil analysis kit*. Soil pH was determined in water suspension (1:1 soil to solution ratio) using a pH meter.

India **Maharashtra** **Amravati**

Figure 1: District Amravati of State Maharashtra India

RESULTS

Soil pH

The pH of soil samples of the present study was in the range of 6.70 to 6.9 indicating that the soils in the study area within the Indian standard specification (6.5 to 8.5). Acid soils have pH values less than 6.6, neutral soils between 6.7 and 7.72 and alkaline soils greater than 7.3. The pH value is found to vary in all the seasons; it is high in the months of winter than that of summer and rainy seasons at all the stations. At station East, the pH is high in the months of September to December. In winter it reaches to 6.9 and in rainy and summer it is in the range of 6.7 to 6.8 (Figure 2).

Soil Nitrogen

Nitrogen is a mobile nutrient in the soil. In the present study the mean value of nitrogen level in soil of Sawanga Vithoba Lake is 701.92 **(**Kg/Ha) (Figure 3). The sewage water significantly increased the nitrogen in the soil (Baddesha et al., 1997). The soil nitrogen in present study area was found to be in the same range in all seasons of year at all stations.

Soil Phosphorus

Phosphorus is an essential element classified as a macronutrient because of the relatively large amounts of Phosphorus required by plants. Value of phosphorus in Kg/Ha is found to be high from June to September at North station (Figure 4). This station is surrounded by the fields. During rainy season phosphorus might have drained off in the lake from fields as farmers use fertilizers in the fields. The Soil phosphorus concentration in present study area was found to be higher 13 kg/Ha in the month of February. The irrigated soil with sewage water contains higher amount of available phosphorous and in rainy season large amount of sewage water get drained into this lake.

Soil Organic Carbon

Soil organic carbon is a key resource owing to its ameliorative effect on nutrient supply, detoxification of harmful soil constituents, retention of moisture and nutrient and its role in soil structure formation.

In present study we found that the soil (sediment) organic carbon was same (nearly 1%) throughout the year but it declined only in the month of June. Much of this loss in soil organic carbon can be attributed to increased decomposability of crop residues, reduced inputs of organic matter, and tillage effects that decrease the amount of physical protection to decomposition.

The value of soil organic carbon in present study area was found to be in the range of 1% in all stations in all seasons of the year except in the month of June, its value in June was found to be reduced to 0.6% (Figure 5).

Soil Potassium

The potassium content was found to vary at different stations. At all the stations values were high in summer and in rainy season as compared to winter. Its highest value was found to be 304 kg/Ha in West station (Figure 6).

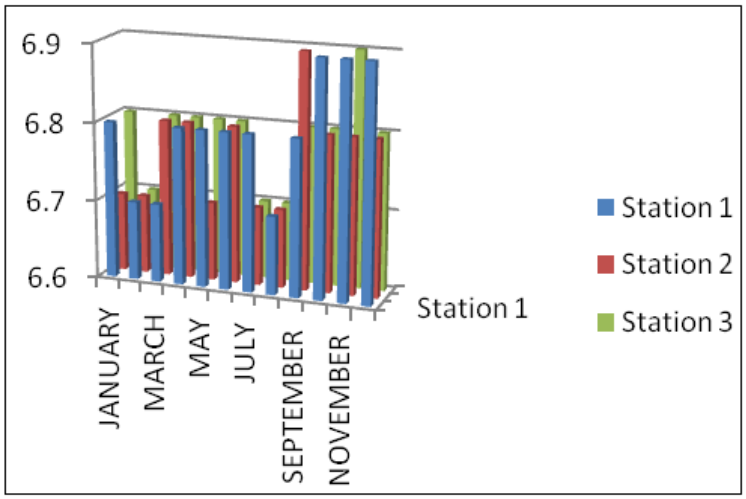

Figure 2: Variation in the pH of Soil at Three Different Stations of Sawanga (Vithoba) Lake throughout the Year. Y Axis Represents pH

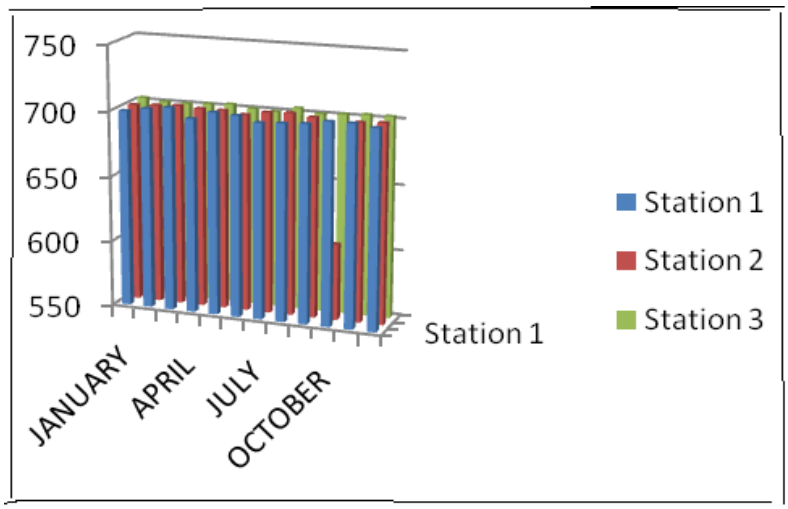

Figure 3: Variation in the Nitrogen of Soil at Three Different Stations of Sawanga (Vithoba) Lake throughout the Year. Y Axis Represents Nitrogen in Kg/Ha

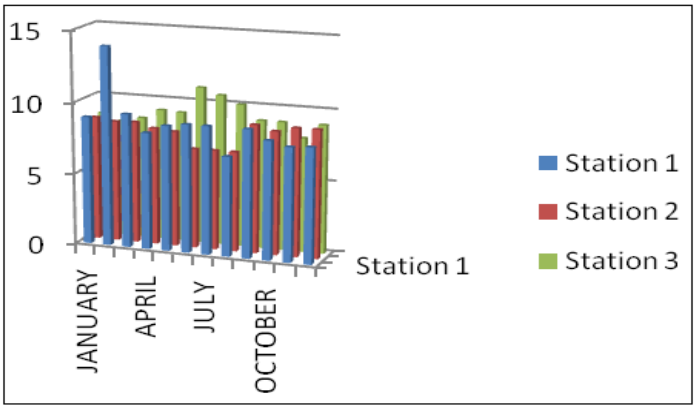

Figure 4: Variation in the Phosphorus of Soil at Three Different Stations of Sawanga (Vithoba) Lake throughout the Year. Y Axis Represents Phosphorus in Kg/Ha

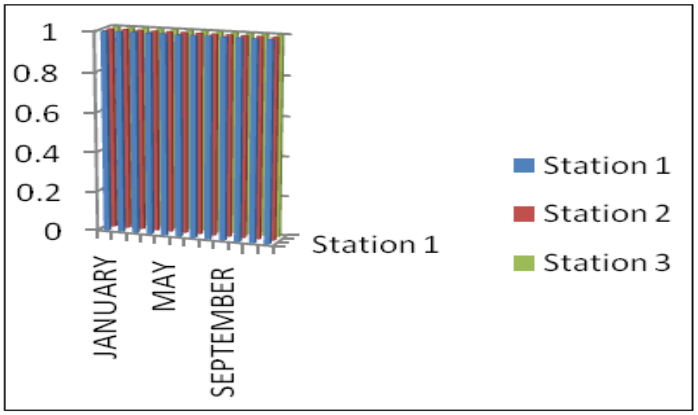

Figure 5: Variation in the Organic Carbon of Soil at Three Different Stations of Sawanga (Vithoba) Lake throughout the Year. Y Axis Represents Nitrogen in %

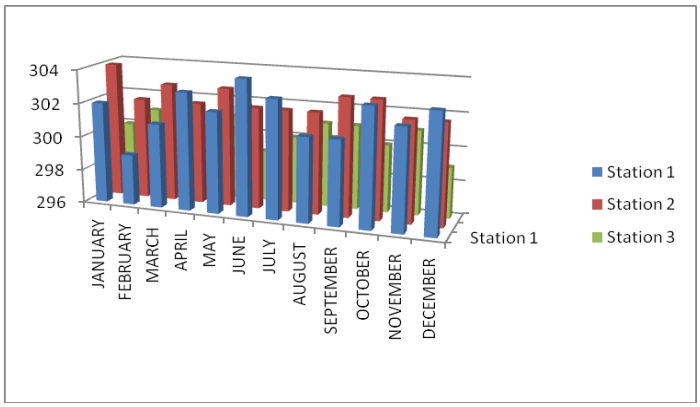

Figure 6: Variation in the Potassium of Soil at Three Different Stations of Sawanga (Vithoba) Lake throughout the Year. Y Axis Represents Potassium in Kg/Ha

DISCUSSIONS

Soils contribution to plant productivity is greatly identified. Soil (Sediment) characteristics of Lake affect water and air quality. Intensive land management practice and imbalance of Carbon, Acidity or alkalinity of a substance can be measured by measuring pH. pH of soil can be considered as one of the important property of soil as it availability of essential plant nutrients are affected by pH. Rainfall also affects soil pH; it decreases during rainy season (De et al., 2009). Basic nutrients like calcium and magnesium are leached away from the soil by the flow of water (Bernstein 1975). In rainy seasons soil has low pH than the soil of dry conditions. The higher pH promotes solubilization of Pb in soil,

increase in the quantity of lead decreases the enzyme activity in soil and also lower microbial activities (Marzodoni et al., 1986), decrease in enzyme activity in soil is the sign of soil pollution.

Nitrogen is the most important element of fertilizers. There is a quick response of plants upon application of nitrogen. Nitrogen gives green colour to the leaves and enhances the growth of the vegetation. Plant roots take up nitrogen in the form of NO_3 and NH_4. Nitrogen and water cycling in soil affect quality of surface and sub surface water. The major contaminant of water is nitrate and nitrogen formed due to conversion of undamaged land to intensive agriculture, animal manures, atmospheric deposition and fertilizers. There is huge increase in the transfer of nitrogen from land to atmosphere and to water bodies, rivers, estuaries and coastal oceans due to human alterations of nitrogen cycles (Vitousek *et al* 1997). Soils containing higher amounts of organic matter generally are capable of releasing higher quantities of nitrogen.

Phosphorus is important nutrient which is added to the soils in fertilizers. The important role of P in living organisms is in the transfer of energy. Phosphorus, like nitrogen, exists in valence states from +5 to -3. Although, thermodynamically, phosphite, hypophosphite, and phosphine can form from phosphate in anaerobic media and their presence has indeed been demonstrated (Hutchinson, 1957; Tsubota, 1959. The main transformation of phosphorus in anaerobic media is the movements of the orthophosphate ion. Soil irrigated with sewage water contains higher amount of available phosphorous which play significant role in plant growth.

Soil composition is an indicator of ecological integrity and development or progress of wetland. The (National Research Council (2000) recently described soil organic matter content (or soil organic carbon) as the “best” indicator of soil quality because it responds to environmental disturbance and influences other functions within an ecosystem (National Research Council 2000).

Soil organic carbon concentrations are relatively low overall with values range from 0.6 to 1%. Status of organic carbon in the influence the availability of micronutrients and heavy metals in soil (Trehan, 1996). Conversion of natural vegetation to cultivated land reduces the soil organic carbon. Various land-uses result in very rapid declines in soil organic matter (Jenny 1941, Davidson and Ackerman 1993, Mann 1986, Schlesinger 1985, Post and Mann 1990).

Potassium (K) is one of sixteen essential nutrients required for plant growth and Reproduction. Potassium forms 2.4 percent of the earth’s crust. It is classified as a macronutrient, as are nitrogen (N) and phosphorus (P). It is taken up by plants in its ionic form (K+). Available K in a soil is generally the sum of water soluble and exchangeable potassium. The reserve forms of K in soils are the non-exchangeable K and the mineral K. As the exchangeable K of soils is removed through cropping or leaching, some of the reserve K derives from weathering of feldspars and micas and become exchangeable (Basavaraja et al., 2011).

Water quality is also influenced by soil management precise like tillage, cropping patterns and use of pesticides and fertilizers. There may be alteration in the soils ability to produce or consume important gases such as carbon dioxide, nitrous oxide and methane due to management practices (Rolston et al 1993 and Mosier, 1998). Quality and health of soil decides environmental quality (Pieizynski *et al* 1994) and plant animals and human health (Haberern 1992 and Harris et al., 1996).

Assessment of quality and health of soil is important to understand the problems of productive areas and to observe the changes in sustainability and environmental quality (Granastein et al, 1992). Applications of indicators of soil quality and health would help to link science with practice in assessing sustainability of management practices (Romig et al., 1996). Indicators of soil quality and health could be exploited to define ecosystem processes and integrate physical, chemical and biological properties, their management sensitivity and variations in climatic conditions and their

utility and accessibility to specialists in the field of agricultural, conservationists and policy makers (Doran and Safley, 1997).

CONCLUSIONS

It was observed that the values of physicochemical parameters of Sawanga Vithoba Lake are in normal range and the soil of the lake is good for the growth of fauna and flora and other vital functions of the lake. Thus this lake may potentially holds rich and diverse flora and fauna.

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